DOCUMENT RESUME

ED 075 224 SE 015 892

TITLE	Activities for Map and Compass Study, Grade Level 4-6. Environmental Education Series, Bulletin No. 247-I.
INSTITUTION	Montgomery County Public Schools, Rockville, Md.
REPORT NO	Bull-247-I
PUB DATE	[70]
NOTE	16p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Curriculum Development; *Elementary Grades; *Environmental Education; Instructional Materials; *Learning Activities; *Map Skills; Natural Resources; Outdoor Education; *Teaching Guides; Units of Study (Subject Fields)

ABSTRACT

This bulletin is one in a series of environmental education activity guides for grades K-12, developed and field-tested by teachers in the Montgomery County (Maryland) Public Schools. Primarily for use in the middle grades four through six, the guides are not intended to constitute complete units in themselves. They are, rather, a compilation of activities considered appropriate for particular environmental studies. In this guide about maps and compasses, for grades four through six, are activities entitled: Estimating Pace, Locating North, Compass Exercises, Landmarks (Azimuth), Shooting a Back Azimuth, Calculating Magnetic Declination, Compensating for Magnetic Declination, Following a Course, Sketching a Map, Estimating Heights, Drawing a Topographic Map, and Mapping. Each activity indicates the instructional objective, procedures to follow, and materials required. Teacher notes are added when necessary. A student evaluation sheet concludes the bulletin. Related documents in the series are SE 015 885 through SE 015 891 and SE 015 893. (BL)

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Activities for

Map and Compass Study

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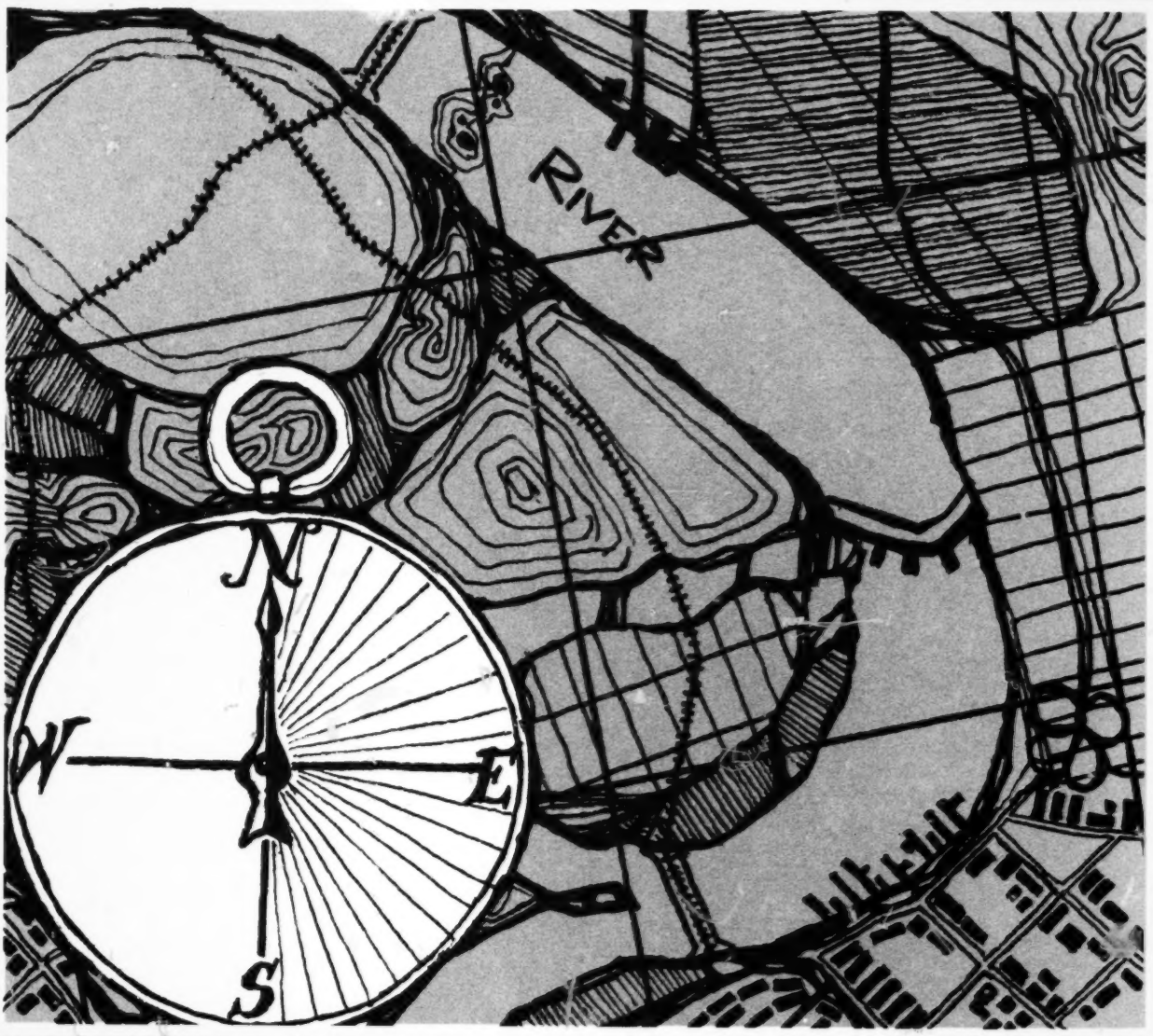

Environmental Education Series · Bulletin No. 247-I

MONTGOMERY COUNTY PUBLIC SCHOOLS, ROCKVILLE, MARYLAND · Homer O. Elsesood, Superintendent of Schools

ED 075224

ENVIRONMENTAL EDUCATION SERIES
ACTIVITIES FOR MAP AND COMPASS STUDY
GRADE LEVEL 4 – 6

Bulletin No. 247-I

Montgomery County Public Schools
Rockville, Maryland
Homer O. Elseroad
Superintendent of Schools

INTRODUCTION

For some time, there has been a need for curriculum materials to assist teachers who wish to move the teaching/learning experience beyond the school walls. Although individual schools have prepared materials useful to their own unique purposes, such information and teaching aids have not generally been shared with other schools.

This series of bulletins on Environmental Education was developed after arrangements were made in Area 11 for approximately a dozen 12-month teachers to produce outdoor education materials during the summer of 1969. Field testing of these materials occurred, primarily in Area 11, during the 1969-70 school year.

In the summer of 1970, an Outdoor Education Curriculum Development Workshop was conducted at Randolph Junior High School, during which twelve teachers developed additional materials and reviewed and tested those prepared earlier.

The bulletins in this Environmental Education series are not intended to constitute complete units in themselves. They are, rather, a compilation of activities considered appropriate for particular environmental studies. Whether the series should be used separately or as a supplement to other aids should be determined by the needs and purposes of each teacher and his students.

A word of explanation about format: Each activity suggested has its own stated instructional objective. The achievement of that objective will be an individual experience for each student, even though in some cases the procedures suggested may be group- rather than individually-directed.

PURPOSE

The use of map and compass can be an integral part of many environmental education activities. The outdoors, where map and compass skills are to be applied, is ideally suited as the "classroom" where those skills should be taught. Most activities included here need to be read in their entirety to be understood clearly; and they often require the successful completion of some previous activities.

These map and compass activities are designed so that the student will be able to perform the following:

1. Locate North
2. Follow a prescribed course
3. Orientate a map
4. Read and interpret a map
5. Sketch a simple map

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Activity 1: Estimating Pace

Instructional Objective:

Using his standard pace, the student will be able to determine the approximate distance between two points with no more than ten percent error.

Procedures:

The student will –

1. Stretch out the tape on level ground.

2. Walk along the tape from one end to the other in his *normal* stride. He should count the number of steps he takes each time.

3. Repeat this pacing three times.

4. Add all the results together and divide the total by three. This will yield the average for 100 feet.

   100 foot example: 45
   46
   43
   3)134
   44 average

5. Divide 100 by the average pace to determine the average length of the pace.

$$44\overline{)100.0}\quad 2.5$$

6. Walk over a predetermined course, estimate the distance, and see whether he is within ten percent of being correct.

Materials:

one or more measuring tapes, 50 feet or 100 feet long
paper and pencil

Activity 2: Locating North

Instructional Objective:

The student will be able to use one or more given methods for locating North.

Procedures:

The student will –

1. Face North and extend arms outward from each side.

2. Name the direction toward which the right/left arm is pointing and the direction directly behind him.

3. Realize that once North has been located, the other cardinal points can easily be determined.

If students are familiar with any methods for locating North, the teacher may use these methods, if practical; or he may use some or all of the following methods:

1. Refer to an almanac or newspaper to learn the time of sunrise and sunset. At the midpoint between sunrise and sunset, observe the direction of a shadow cast by an upright object. This shadow points North.

2. Observe shadows at different periods of time. By noting the variation in shadow length, generalize that when a shadow is shortest, it is then pointing toward the North.

3. Observe the position of the sun at sunrise and sunset to learn the general direction of east and west. (The relative position of the sun varies according to the season.)

4. Learn the time of moonrise and moonset. Calculate the time halfway between. Face the moon at that time and North will be directly behind you.

5. Locate the North Star and become familiar with the configuration of the Big Dipper and its position relative to the North Star.

6. Place a watch in a horizontal position with the hour hand pointing toward the sun. A line halfway between the hour hand and 12 o'clock points toward the South.

7. Drive a stake vertically into the ground. Mark the tip of the shadow. After 10 minutes or more, mark the present tip of the shadow and draw a line through those two points. This line is East and West and the second point is always East.

Materials

watches
magnetic compasses

Note:

It is commonly accepted that moss grows only on the North side of a tree; but this is often not the case. The students could attempt to verify this generalization by observing moss growth on trees in different environments (an open field, a wooded area, near buildings, etc.); and using a compass, compare this with the direction of North.

Activity 3: Compass Exercises

Instructional Objective:

The student will be able to point out the cardinal directions (North, South, East, West) using a magnetic compass and be correct within 5°.

Procedures:

1. Give each child a magnetic compass.
2. Tell him that the painted or arrow end of the pointer points to the magnetic North Pole.
3. Have him find which direction North is. Have him face North.
4. Turn the compass until the painted end of the pointer is directly over the N on the compass.
5. Ask the student to name the nearest object which is vertical to the ground (tree, house, etc.) in each of the four cardinal directions (North, South, East, West).

Materials:

a large clear area (playground)
a magnetic compass (silva compass will serve best)

Note:

1. Additional activity for indoors could be to fold a large paper circle into sixteenths and label to show the 16 points of a compass.
2. The students may, time permitting, wish to repeat the procedures and find NE, SW, SE, NW.

Activity 4: Landmarks (Azimuth)

Instructional Objective:

The student will be able to name the azimuth of any given landmark within 5° by using a magnetic compass.

Procedures:

1. Have the student hold his compass flat and steady, then turn himself until the painted end of the pointer is over the "N" on a compass.

2. The teacher should select a landmark on a direct line with one of the cardinal directions and point this out to his students, explaining that a compass is a circle and is divided into 360°.

N 360°
W 270° E 90°
S 180°

3. Ask the student what the degree reading of the landmark is.

4. Explain that this reading is called the *azimuth.*

5. Give each student several landmarks and ask him to find and record the azimuth of each.

Materials:

one magnetic compass per student

Activity 5: Shooting a Back Azimuth (Backsighting, or Return Course)

Instructional Objective:

Given the azimuth of a landmark, the student will determine and record the reading he would follow on a return course (backsighting).

Procedures:

1. Give the student the azimuth of a particular landmark.

2. Have the student compute back degree reading by adding 180° to the given azimuth, if it is 180° or less; or by subtracting 180° if the given azimuth is more than 180°. Record this.

3. For practice, the teacher may give readings and distances of a course. Students should record reading and distances for the return course.

Materials:

a magnetic compass per student
paper and pencil for each student

Activity 6: Calculating Magnetic Declination

Instructional Objective:

The student will be able to calculate the magnetic declination of a given region.

Procedures:

1. Following a discussion of the variation between true North and magnetic North and the implication of these variations, some of the students might be assisted in figuring out the angle of declination (variation) for their location.

2. Globes should be provided and students aided in locating magnetic North and true North. Then the students might estimate the angle of declination for their location. The students could be asked to suggest ways to determine the angle of declination.

3. To calculate the angle of declination, the student will locate true North. He may do this by locating the North Star, by using a stick shadow when the sun is at its zenith, or any other known method. The teacher may elect to tell him.

4. The student will draw a line from a given point "A" toward true North. The line may be drawn on paper, on the ground, etc. He will then use a compass to locate magnetic North and draw a second line from point "A" toward magnetic North. The measure of the angle formed by these two lines is the *angle of declination.*

Materials:

one magnetic compass per student
one protractor per student
paper and pencil for each student
globes (one for each 5 students)

Note:

To learn the current magnetic declination for a given area, refer to an almanac or contact a local surveyor.

Activity 7: Compensating for Magnetic Declination

Instructional Objective:

The student will be able to adjust compass readings to compensate for the magnetic declination.

Procedures:

1. Students will be informed that directions on maps are in relation to the North Pole (true North). However, the compass needle points to magnetic North, not to true North. True North and magnetic North may or may not be the same.

2. Using globes, help students locate the north magnetic region and geographic North. Students should make observations and discuss implication of variation between North and true North. (This variation is called the *declination*.)

3. Maps showing lines of declination may be examined so that students can better understand variations and implications of variations.

4. Referring to maps (3. above), students should determine approximate angle of declination for their area. (Angle of declination changes from time to time as well as from place to place.)

5. The student will locate true North by first aligning the compass needle with N on the compass card. Then (for Montgomery County) rotate the card clockwise 8 degrees. The card is now in line with true North, and correct readings (azimuths) can be made.

Materials:

globes (one for each 5 students)
maps showing lines of declination
one compass per student
paper and pencil for each student

Note:

If additional activities are needed, use the following:

1. Designate a number of observable landmarks. Students will sight and use compass to determine correct azimuth of each.

2. Select a number of observable landmarks and determine true reading of each. Students will be given readings based on magnetic North. They will make corrections and identify each landmark.

3. Lay out a course based on true North. Students will be given readings based on magnetic North. They will make corrections and follow the course. (It will also be necessary to specify the distance from one point to the next.)

Activity 8: Following a Course

Instructional Objective:

The student will be able to demonstrate his ability to use a compass by following a prescribed course.

Procedures:

1. Have students practice walking in a straight line by sighting an object and walking a specified distance (approximately 100 ft.) toward that object.

2. Lay out a course consisting of four or five stations. Now give the student the azimuth and distance from one station to the next. Direct him to perform a task at each station before proceeding to the next, such as: "Pick up a card that has your name on it." "Name a large object found near the station." "Record the time." "Give the azimuth you would follow if you returned directly to the starting point." (Station markers could be small so student would have to be reasonably accurate in order to locate them.)

Materials:

one compass per student
paper and pencil for each student
tapes for measuring (if needed)
coat hangers and red material for markers

Note:

If additional activities are needed, use the following:

1. Students may lay out a course that includes four or five easily recognizable landmarks. Have other students identify the landmarks and give the distance and azimuth from each one to the next.

2. The teacher may identify about five prominent landmarks. Students will then determine readings and distances. They will then sketch a course and specify readings and distances.

3. The teacher may plan a course that includes no observable landmarks. The student will be given readings and distances. Using only a compass and an appropriate measuring device, the student will travel the teacher's pre-determined course.

4. The student may construct a geometric shape by following a prescribed course (e.g., a square). The student should place a marker at a point designated by the teacher. He will walk 10 steps at an azimuth of 90° and place a 2nd marker; 10 steps at 180 ° and place a 3rd marker; 10 steps at 270° and place a marker; 10 steps at 360° and place a final marker. (First and last marker *should* be at the same point!)

Activity 9: Sketching a Map

Instructional Objective:

The student will be able to draw a sketch map showing true and magnetic North, at least five landmarks, five symbols from the list provided, and distances in a scale.

Procedures:

1. Select an arbitrary starting point for the student to work from.
2. Have him find a landmark at each of the cardinal directions.
3. Have him pace off the distance to each landmark. (Be certain that it can fit on the paper.)
4. Select a scale to use (e.g., 1 inch = 10 ft.).
5. Have the student place each landmark at the proper place and distance on his map.
6. Have him place on his map at *least* one other landmark at the proper azimuth (bearing) and distance.
7. Then have him add at least five other objects on his map, using the list of symbols provided.

Materials:

magnetic compass
pencil, paper
straight edge
list of symbols (obtained free from the U.S. Geological Survey)

Activity 10: Estimating Heights

Instructional Objective:

Using his hand and any straight object, the student will be able to estimate the heights of various objects within 10 percent of their correct height.

Procedures:

The student will——

1. Take a straight object and mark it with a narrow piece of tape just above the point where he holds it with his hand.

2. Stand at any arbitrary distance from a wall that has been visibly marked at a height of 5 feet.

3. Holding the straight object vertically at arm's length, sight the bottom of a wall at the point where the tape has been placed.

4. Place a second piece of tape on his stick where he sees the 5-foot mark on the wall. (The distance between the two pieces of tape will correspond to 5 feet.)

5. Move the *same* arbitrary distance away from any given object.

6. Estimate the height of the object within 10 percent of its correct height by using the measuring device just made.

Materials:

any straight object (stick, pencil, ruler, etc.)

Note:

Additional explanation and materials may be found on page 124 of the 6th grade teachers guide, *Concepts in Science.*

Activity 11: Drawing a Topographic Map

Instructional Objective:

The student will be able to draw a topographic map of a hill.

Procedures:

1. The teacher should select an area with a valley or a depression with a hillside.

2. Explain that the low spot is to be considered 0 ft. above sea level, and have the student mark and label it on his paper representing the area.

3. Ask the student to sight along his straight objects (as marked in Activity 10) until he finds an object (such as a stone or stick) at 5 ft. of elevation. Have him mark this on his paper.

4. Pick several students to stand along the 5 ft. elevation line determined by another student sighting along his straight object.

5. Have the student draw lines showing where these people are standing by connecting dots on his paper. This represents a countour line.

6. Repeat Procedures 3, 4, and 5 for each 5 feet of elevation until the top of the hill is reached.

Materials:

paper and pencil
straight object (stick, pencil, ruler, etc.)
straight edge
list of symbols

Activity 12: Mapping

Instructional Objective:

Each student will construct a map of a given area (100 sq. ft. or larger), including at least 10 landmarks using five different symbols (see page 11), one land form (topographic lines at 5 foot intervals), the cardinal directions, true North, and a scale.

Procedures:

1. Select a 100 sq. ft. (or larger) area that includes some topographic features.
2. Show the student the boundaries of the area with a landmark designating each of its four corners. (If landmarks are not available, a pile of stones may be used.)
3. Review the meanings of landmarks, symbols, topographic lines, cardinal directions, true North, and scale.
4. Give the student an arbitrary point from which to work.
5. Have him orient his compass to North.
6. Have him construct a map of the area.

Materials:

compass
straight object
pencil and paper

STUDENT EVALUATION SHEET

Student's Name_____

	Observed	Not Observed
1. Determines approximate distance	_____	_____
2. Locates North	_____	_____
3. Identifies directions	_____	_____
4. Names azimuth	_____	_____
5. Names back azimuth	_____	_____
6. Calculates magnetic declination	_____	_____
7. Compensates for magnetic declination	_____	_____
8. Follows a course	_____	_____
9. Draws a sketch map	_____	_____
10. Estimated heights	_____	_____
11. Constructs topographic map	_____	_____
12. Construct a map	_____	_____